

## SPECIFICATION

Title of the Invention:  
EVACUABLE BAG

Background of the Invention:  
Technical Field:

The present invention relates to an evacuable bag which is to be deaerated after it contains an article.

Background Art:

As disclosed in Japanese publication No. H01-294027, there existed in the past evacuable bags which have an air outlet formed on the bag main body made of flexible synthetic resin for compacting an article such as clothing and beddings in the bag.

To be brief, the way of use comprises putting beddings etc. through an opening into the evacuable bag, then closing the opening by means of a sliding fastener, attaching the nozzle of a vacuum to the air outlet to suck up the air inside the bag, so that the air can be expelled from the outlet. And then, the evacuable bag can be retained vacuumed by shutting the air outlet against incoming air. When the bag containing an article such as clothing and beddings is deaerated, the air within the contents may also be sucked out simultaneously. So the size of the package may become small as much as the volume has reduced.

In addition to the above purpose, if food such as meats and vegetable as packed under negative pressure in the evacuable bag is preserved in the refrigerator, it can be protected from spoilage caused by the air in the bag.

Said prior art evacuable bags are made of laminated sheets of synthetic resin film, such as nylon or polyethylene, and partially heat-sealed.

The surface of each laminated sheet is smooth, and when the bag is evacuated, the opposite inner sides of the evacuable bag are brought into close contact with each other. However, in deaeration by a vacuum, laminated sheets corresponding to the air outlet in position may partly stick to each other during

the process, thus resulting in incomplete deaeration.

In this connection, the above Japanese publication No. H01-294027 has proposed "TUBULAR CONTAINER", in which the surface of the synthetic resin films constituting laminated sheets is made uneven by embossing process, thereby preventing the laminated sheets from sticking to each other at the inner side of the evacuable bag. With this prior art container, the laminated sheet has an embossed surface in a checked pattern, which may avoid contact between the surface of the laminated sheets to achieve complete deaeration.

However, such a way of making a raised pattern on the surface of the laminated sheet may cause a high cost of production.

Meanwhile, for the sake of better appearance, there have been laminated sheets consisting of an embossed sheet with a random pattern called in Japanese "Unryu", which literally means clouds and dragons, as conventionally used on Japanese paper, and a sheet of synthetic resin film. The inventor of the present invention has figured out a way of using the uneven surface of said sheet of a Japanese-paper style so as to avoid any possible contact between the laminated sheets.

However, it was found that the Japanese-paper-style sheets were composed of natural fibers, or rayon fibers used in a paper-making process and not desirable concerning heat-sealing.

Thus, with the uneven surface of the Japanese-paper-style sheets laid down inside the evacuable bag, the laminated sheets did not be heat-sealed in a bag-making process. In order for the Japanese-paper-style sheets to make hot-sealable, it was necessary to have the sheet backed with a synthetic resin film like a polyethylene film. But, this additional process will result in covering the entire surface of the Japanese-paper-style sheet with the backing film, whereby the uneven surface will not appear on the back face of the sheet, only to fail an achievement the inventor intends.

In view of this, the object of the present invention is to provide an evacuable bag in which complete deaeration can be carried out with no accompaniment by any possible contact between the laminated sheets, and the production process can be performed at a low cost.

## Summary of the Invention

For the purpose of overcoming said problems, a first aspect of the present invention provides an evacuable bag having a bag body 1 constituted by flexible non-breathable laminated sheets 11, the body 1 comprising an air-outlet 2 which permits the body 1 to communicate with the outside, and a closable opening 3, so that air in the body 1 may be evacuated through said air-outlet 2, wherein the laminated sheets 11 consists of at least two layers, of which the outer layer being a combination of non-breathable synthetic resin films 12, 13, the inner layer a nonwoven layer 14 made of a mass of synthetic fibers, and said nonwoven layer 14 has thermoweldability.

A second aspect of the present invention provides the evacuable bag as defined in the first aspect of the present invention, wherein said nonwoven layer 14 has a ground texture 14a and islet textures 14b which lie scattered on the ground texture 14a and arranged in a manner to rise from the ground texture 14a, the surface of the nonwoven layer 14 is rendered uneven by the ground texture 14a and islet textures 14b, and at least one cluster of unevenness is formed on the nonwoven layer 14 in a portion 2a for air flow located near the air-outlet 2 and in the bags main body 1.

A third aspect of the present invention as defined in the second aspect of the present invention, wherein referring to the unevenness as defined by the ground texture 14a and islet textures 14b, the average of the size difference H between the minimum size of the nonwoven layer 14 in the ground texture 14a in the direction of thickness of the nonwoven layer 14 and the maximum size of the nonwoven layer 14 in the area of the islet textures 14b preferably ranges from 50 microns to 300 microns.

A fourth aspect of the present invention as defined in the second aspect of the present invention, wherein the synthetic fibers constituting the nonwoven layer 14 is polyolefin synthetic fibers.

A fifth aspect of the present invention as defined in the fourth aspect of the present invention, wherein the outer layer of the laminated sheet 11 consists of nylon film 12 and

polyethylene film 13 piled up in this order as viewed from the outside of the evacuable bag 10, in the nonwoven layer 14, which is the inner layer of the laminated sheet 11, said ground texture 14a consists of polyethylene synthetic pulps and polyethylene-polypropylene conjugate fibers, and the two opposed nonwoven layers 14 lying in the inner sides are adhered to each other by heat seal into a bag main body 1.

#### Brief Description of the Drawings:

FIG. 1 is a plan view showing the evacuable bag in accordance with one embodiment of the present invention.

FIG. 2(A) is a cross sectional diagram showing a laminated sheet of said evacuable bag. FIG. 2(B) is a perspective diagram showing a nonwoven layer of said evacuable bag. FIG. 2(C) is a partially enlarged and cross sectional diagram of FIG. 2(B) taken along a line I - I.

FIG. 3 is a diagram showing a specific production process for stock sheet 14s of the nonwoven layer 14 in accordance with the present invention.

#### Detailed Description of the Preferable Embodiment:

The present invention will be described with reference to an embodiment.

An evacuable bag 10 of the present embodiment has a bag main body 1 made of two plane laminated sheets 11 of a flexible and non-breathable nature, the laminated sheets laid one upon another and being heat-sealed at predetermined section such as the edges, said main body 1 having a tight-sealable space to contain an article.

The bag main body 1 includes a closable opening 3, where a fastener 31 is disposed for hermetic closure of the opening 3.

The bag main body 1 also includes an air-outlet 2 which admits to the outside thereof. In the present embodiment, the air-outlet 2 is formed with a check valve 21. In brief on its structure, the check valve 21 is made of plane synthetic resin sheets laid one upon another, serving to allow air flow from inside to outside the bag main body 1, while checking the air flow in the reverse direction. After an article is put in the

bag main body 1 and the opening 3 is closed, the air inside the main body 1 can be manually compressed, or smoothly deaerated from the edge of the bag, which contains the article of a large-sized configuration such as beddings, by using a vacuum to attach the nozzle thereof to the air-outlet 2. And the check valve 21 may check air flow from outside the bag to ensure that the bag main body 1 will maintain the deaerated state.

As shown in FIG. 1, an air passage 22 is formed by heat-sealing the laminated sheets 11 outside the check valve 21, so the check valve 21 will not move outside the evacuable bag 10. However, said air passage 22 is not essential to the present invention. It may be omitted accordingly.

The evacuable bag 10 in accordance with the present invention may not be restricted to the above-mentioned configuration. For example, the bag main body 1 may be formed by folding a piece of laminated sheet 11. The volume of the bag main body 1 may be made larger by providing a gusset at the lateral sides and/or the bottom side. Instead of provision of the check valve 21 in the air-outlet 2, closing means such as a cover, tap or fastener may be employed to prevent incoming air from outside the bag main body 1. Deaeration without the air-outlet 2 may be carried out through the opening 3. Or the opening 3 and air-outlet 2 may not be limited to be positioned at the edge of the bag main body 1, may be disposed on the surface of the main body 1. Thus, the evacuable bag 10 of the present invention can be designed in different structures.

As shown in FIG. 2(A), the laminated sheets 11 in the evacuable bag 10 in accordance with the present invention are formed integrally by laminating a plurality of resin films, each of which has appropriate compositions for specific applications. In the present embodiment, the laminated sheets 11 are composed of three layers.

The laminated sheets 11 of the embodiment are formed by laminating a nylon film 12, a polyethylene film 13, and a nonwoven layer 14 in this order. The nonwoven layer 14 is disposed as an inner surface of the bag main body 1 in forming the bag main body 1.

Although on both inner surfaces of the evacuable bag 10 in

this embodiment are disposed the nonwoven layer 14, the present invention is not limited to this. It may be arranged only on either inner surface.

The nonwoven layer 14 consists of synthetic fibers. In this embodiment, the synthetic fibers used here are polyethylene synthetic pulps and polyethylene-polypropylene conjugate fibers. The synthetic fibers should not be restricted to the abovementioned articles, and choice may be made of a variety of compositions. However, at least one of the synthetics must be thermoweldable. For example, polyolefin synthetic fibers may be applicable. Incidentally, polyolefin is chain hydrocarbon having a double bond, and means polymer as formed by addition of polymerization of olefins, which is shown in its general formula  $C_nH_{2n}$ , such as ethylene ( $C_2H_4$ ), propylene ( $C_3H_6$ ), and butylene ( $C_4H_8$ ). In this embodiment, the respective different fibers are bonded by thermofusing of part of polyethylene among said synthetic fibers.

Forming process of the nonwoven layer 14 is to join said synthetic fibers together into a sheet-like web, and fuse some of the synthetic fibers with thermoweldability, polyethylene in this case, by heating said web into an integrated sheet.

In this embodiment, the nonwoven layer 14 has a ground texture 14a and islet textures 14b. The islet textures are arranged to lie scattered on the ground texture 14a, or the arrangement may be so-called "island-in-the-sea" arrangement. The ground texture 14a is relatively of a fine texture, consisting of polyethylene synthetic pulps and polyethylene-polypropylene conjugate fibers, while the islet texture 14b is relatively of a coarse texture, consisting of polyethylene-polypropylene conjugate fibers. This is because the islet texture 14b is composed of synthetic fibers gathered into a single solid of high density.

Having thus arranged, the nonwoven layer 14 presents a random pattern resembling an old Japanese design called "Unryu", which literally means "clouds and dragons" in appearance. By varying the islet textures 14b into different shapes, the diversity of patterns other than the above Unryu pattern can be obtained.

The use of the synthetic fibers tinged with pigment may create colorful nonwoven layer 14. In the present embodiment, titanium oxide has been applied to the polyethylene-polypropylene conjugate fibers, thereby taking white color. Furthermore, ornaments such as metallic foil or tinged resin pieces may lie scattered together with islet textures 14b on the ground texture 14a in such a manner that they will not be the least inconvenience at the time when the unwoven fabric is heated.

Now, a production method for stock sheet 14s of the nonwoven layer 14 in accordance with the present invention will be explained specifically with reference with FIG. 3 by way of example.

The polyethylene-polypropylene conjugate fibers comprising the ground texture 14a (hereinafter called "fiber A") has a structure composed of a sheath portion made of polyethylene and a core portion of polypropylene, a single fiber being 3.3 decitex (dtex) in thickness and 15 millimeter (mm) in length.

The polyethylene-polypropylene conjugate fibers consisting of the islet textures 14b (hereinafter called "fiber B") has a structure composed of a sheath portion made of polyethylene and a core portion of polypropylene and a single fiber being 3.3 dtex in thickness and 25mm in length.

Referring to the components constituting the nonwoven layer 14 of the present embodiment, the weight ratio of polyethylene pulps (hereafter referred to as "pulp"), fiber A, and fiber B is respectively 40%, 50%, and 10%.

The size of single fibers for fibers A, B is not restricted to the abovementioned. The thickness may be 1 to 7dtex, preferably 2 to 4dtex, and the length 10mm to 20mm for fiber A, and 20mm to 30mm for fiber B.

A web 14W, a layer-like aggregate of the pulps and the fibers, is produced by a process using a round net.

In this process, pulps and fiber A are at first agitated in the water within a first agitating tank 21. The pulps are subjected to beating before introduced into the first agitating tank 21 so as to facilitate subsequent intertwining

of pulp fibers.

On the other hand, fiber B and a sticking agent are agitated in a second agitating tank 22 into an aggregate of fibers which is to become islet textures 14b. For production of conventional type of unwoven fabric using rayon fibers, said aggregate could easily be formed merely by agitating rayon fibers and a sticking agent. However, since it is difficult for olefin fibers like fiber B of this embodiment to aggregate themselves in the level of fiber unit, it is impossible to make an aggregate of fibers by the production method applicable for rayon fiber aggregate. In this connection, prior to mixing with a sticking agent, fiber B is soaked in an anchoring agent so as to facilitate its coherence, and then, agitated together with the sticking agent until the fiber aggregate has been formed.

Then, the pulps and fiber A as agitated in the first agitating tank 21 and the aggregate of fiber B as agitated in the second agitating tank 22 are mixed together, and introduced into a tank 23. The pulps, fiber A, and fiber B are taken with the round net 14 now in rotary motion as disposed within the tank 23, and then, transferred to felt 25 sliding as it keeps in contact with the round net 24, thereby forming a web 14W. The round net 24 is a cylindrical object defined by a metallic net with very small meshes.

The resultant web 14W is conveyed to a dryer 26. The dryer 26 here used is a so-called Yankee Dryer, which serves to dry the web 14W moving on a heated roller.

The dried web 14W is then transferred to a heat suction unit 27. In this production process, heated air 27, which is lower than the melting point of polypropylene in the core portion of the fibers A, B, and higher than that of polyethylene in the sheath portion of the pulps and the fibers A, B, specifically 100°C to 150°C at the temperature, is transmitted through the web 14W, whereby some portion of polyethylene in the pulps and the fibers A, B of the web 14W will melt. This may cause the pulps and fibers A, B to join together into a stock sheet 14s.

As the entire stock sheet 14s thus produced is composed of olefin synthetic fibers, it is heat-sealable unlike the

conventional Japanese-paper-style sheet using natural fibers or rayon fibers. Therefore, the nonwoven layer 14 can be attached on the inner surface of the evacuable bag 10. Additionally, it is not necessary to have said stock sheet 14s backed by synthetic resin like polyethylene, as has been practiced in the past. This may help cost-reduction on the production.

In addition to the abovementioned, referring to a matter of severance, fusion cutting was not applicable to the conventional Japanese-paper-style sheet, and the only cutting way ended up in a cutter. However, the stock sheet 14s of polyolefin constituting the nonwoven layer 14 of the present invention can be fusion-cut. Therefore can be selected the optimum severance for each of specific production processes, which may help reduce production cost.

Furthermore, as a secondary effect due to the provision of the nonwoven layer 14 with an appearance of the Unryu pattern of a Japanese-paper-style, the evacuable bag 10 having an excellent appearance is provided.

As illustrated in FIG. 1(B), the islet textures 14b of the nonwoven layer 14 lie scattered on the ground texture 14a, and in FIG. 2(C) which is a cross sectional view, at least some of the islet textures 14b are arranged as if they float in the ground texture 14a. The islet textures 14b rise from the surface of the ground texture 14a, which renders the surface of the nonwoven layer 14 uneven. This unevenness depends upon the state of the synthetic fibers constituting the islet textures 14b, and the degree of "protrusion" of the islet textures 14b from the surface of the ground texture 14a, so that though it is not uniform as a whole, the average value of the size difference H between the minimum size of the nonwoven layer 14 on the ground texture 14a in the direction of thickness of the nonwoven layer 14 and the maximum size of the nonwoven layer 14 in the area of the islet textures 14b preferably ranges from 50 microns to 300 microns.

And the nonwoven layer 14 is stuck on the synthetic resin films 12, 13 in a fashion to lie on top until a laminated sheet has been formed, then, a bag main body 1 is formed by the

nonwoven layer 14 arranged as an inner layer in the inner surface thereof.

In case of the conventional evacuable bags as made of laminated sheets with smooth surface, the areas of the laminated sheets in the position corresponding to the air-outlet were inclined to closely contact with each other in deaeration, thereby leading to incompleteness. However, with the evacuable bag 10 in accordance with the present invention, both inner surfaces of the body 1 of the evacuable bag 10 are composed of nonwoven layers 14 with the surfaces rendered uneven by the ground texture 14a and islet textures 14b, so that the inner surfaces may be immune from undesirable contact to ensure the suitable maintenance of interspaces which permit air flow in any event. In deaeration the air in the bag main body 1 can be easily led to the air-outlet 2 and ensure complete deaeration.

It will be noted that at least one cluster of unevenness is formed on the nonwoven layer 14 in a portion 2a for air flow located near the air-outlet 2 in the bag main body 1. This region 2a may be wide enough to prevent any subsequent contact between the laminated sheets 11 and to secure an air passage to the air-outlet 2, specifically, the range of the region 2a shall be within 50mm from the air-outlet 2 (in the present embodiment, the internal open end 21a of the check valve 21).

It will also be noted that the formation of the islet textures 14b is not essential in the present invention. Even if the nonwoven layer 14 has been formed only by the ground texture 14a, as the ground texture 14a itself is made of synthetic fibers twisted together, it has an uneven surface, which may afford an effect similar to the abovementioned.

In the case of the production of the nonwoven layer 14 can be used the known production process for general nonwovens just as it is, such as a paper-making process, carding process, air-lay process, spanbond process, or melt-blow process. The foregoing process using the round net is a kind of the paper-making process. Therefore, as compared with the prior art method of rendering uneven the surfaces of the synthetic resin film constituting the laminated sheet as disclosed by

the aforementioned patent publication, the production can be conducted at much lower cost.

This particular evacuable bag 10 is most suitable for use in bulky objects as impregnated with air, such as beddings, articles of clothing, and foods which may spoil by air contact, as meat, vegetables. It is well adaptable to other different objects without limitation to the abovementioned.

When in use, the evacuable bag 10 always can retain an interspace for admitting air flow which may arise from the fact that the laminated sheets 11 will never stick to each other because both inner sides of the body 1 of the evacuable bag 10 are constituted by nonwoven layers 14 with uneven surface. Thus, during evacuation, air within the bag body 1 is smoothly led to the air-outlet 2 to ensure complete deaeration.

Additionally, for the production of the nonwoven layer 14 can be used the known production process for the general nonwovens, such as a paper-making process, carding process, air-lay process, spanbond process, or melt-blow process just as it is. Therefore, as compared with the conventional method of rendering uneven the surfaces of the synthetic resin films consisting the laminated sheets, production can be performed at much lower cost.

Unlike the conventional Japanese-paper-style sheets containing natural fibers or rayon fibers, the sheets of the present invention can be heat-sealed into a bag main body, and moreover, the backing process for synthetic resin, as polyethylene, for rendering the sheets heat-sealable is not necessary, which may help cut production cost accordingly.

Additionally, because the nonwoven layer 14 looks like Japanese paper in appearance, the evacuable bag has an excellent appearance.